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AUTOMATION PROBLEMS IN MACHINE BUILDING IN THE USSR

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It is contemplated that the production of at least 520 types of general-purpose automatic and semiautomatic machine tools, not counting the tens of thousands of special automated machine tools, will be mastered in 1960. The design of these machine tools will be changed substantially. For example, the traditional system of automatics in which the working components are controlled by cams will give way to hydraulic and electric couplings (svyazi). This will greatly simplify the setting up of the machine tools and increase their productivity.

In modern machines, especially in aircraft and turbine building, parts are used which have the shape of intricate three-dimensional curves. The use of electric and hydraulic copying machines has made it possible to machine these parts.

Besides copying, programing devices have been used more widely in recent years.

The further development of programing device systems lies in the utilization of computing devices (schetno-reshayushchoye ustroystvo) in metalworking. The use of these devices will make it possible to machine to a high accuracy parts of any shape or size according to a formula, bypassing blueprints and templates. A shortcoming in the programing device systems is the lack of a feed-back ("obratnaya svyaz'"). Signals to the actuating controls of the machine tool can be given with extremely high accuracy; however, the correctness of the fulfillment of these signals by the programing devices is not checked. When parts are machined on metal-cutting equipment, there is intensive wear of the cutting tool, and the original setup of the machine tool becomes involuntarily changed as a result of heat deformations and inadequate rigidity of the system. For this reason, even with extremely accurate control signals, the actual dimensions of the machined parts can deviate substantially from the specified dimensions.

This problem can be eliminated to a considerable degree by increasing the wear resistance of cutting tools, by improving the design of machine tools, and by using electric contact or pneumatic measuring devices to measure the part while it is being machined and give signals on its dimensions. Such instruments, although not yet available in sufficient quantities, are being produced by the Moscow Kalibr Plant and can easily be built into the kinematic system of a machine tool and control its operation.

Hydroautomation (gidroavtomatika) is acquiring increasing importance in automating the metalworking process. If one considers electroautomation (elektroavtomatika) the brain and nerves of modern machines, then hydraulics can rightfully be called the muscles of the machine. The inherent possibilities in hydraulics, the transmission of power to any distance and to any part of the machine tool by the simplest means, make hydraulics indispensable in the automation of modern machine tools.

The basic problems involved in a further increase in the technical level of the hydraulic drive of machine tools are to increase their reliability and life and to decrease their size. Standard elements for the hydraulic drive, which have been developed by ENIMS (Experimental Scientific Research Institute of Metal Cutting Machine Tools) and which are being series-produced at

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specializing plants, are making it possible to use extensively tested designs of inexpensive apparatus. The problem concerning the life of one of the most important parts of the hydraulic system, the hydraulic pump, has not yet been completely solved. The pumps which have been produced by Soviet industry are still considerably inferior to the best foreign models in design and quality.

The current level of technical development makes it practical to automate even the most complex metal-cutting machine tools. There appear to be unlimited possibilities for the further improvement of automation equipment (sredtsva) and for increasing the degree of automation of a large number of metal-cutting machine tools. This will make possible a manifold increase in productivity, as well as greatly improved working conditions for workers and machine tool operators.

The party and government are constantly emphasizing the need for complex mechanization and automation which will embrace not only basic, but also secondary processes.

Automatic-transfer machine lines made up of unit-type machine tools are being used most extensively in branches of machine building engaged in mass production. These lines are intended primarily for machining housing parts, such as cylinder blocks and cylinder heads. In recent years, machine-tool builders have manufactured dozens of these lines. Operating practice has shown their high degree of effectiveness. Automatic-transfer machine lines for machining cylinder blocks for combine engines at the Khar'kov Serp i Molot Plant have made it possible to increase the output per worker to 11.7 times and the output per production worker to 25.3 times the former rate. The output per square meter of production area increased 32 percent and the cost of machining decreased 36 percent.

However, in spite of the obvious practical advantages of automatic-transfer machine lines for machining engine housings, they have not yet received widespread use. The machining of cylinder heads (kryshka) has been automated at the Stalingrad and Khar'kov tractor plants; however, the ZIS (Moscow Motor Vehicle Plant imeni Stalin) and GAZ (Gor'kiy Motor Vehicle Plant imeni Molotov) plants machine the heads on individual machine tools. Only the Moscow Motor Vehicle Plant has an automatic-transfer machine line for machining gear cases.

Machine-tool builders have developed automatic lines for the complex machining of shafts for electric motors, and plowshares and moldboards for tractor plows. They have also developed lines for making bolts, nuts, and other parts. The complex automation of the manufacture of motor vehicle pistons, including not only machining, but also casting operations, has been accomplished.

A substantial contribution toward the development of automation was made recently by machine-tool builders with the development of an automated shop for the mass production of ball and roller bearings. In this production, besides the automation of machining and heat treatment operations, the assembly and packing of bearings have also been automated.

In recent years, machine-tool builders have built more than 40 complex automatic lines and complex automated production systems made up of automatic-transfer machine lines. The complex automation of all basic types of machining, of many types of heat treatment, and of checking has been tried on them. The automation of press-forging and foundry operations has been accomplished on a somewhat smaller scale.

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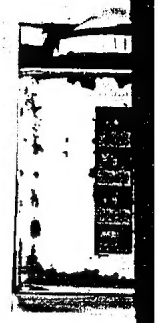

The directives of the 20th Congress of the CPSU for the Sixth Five-Year Plan specify that the machine tool building industry must increase the production of automatic and semiautomatic lines and equipment for automatic shops and plants to five times its present level. For this, it will be necessary to conduct large-scale scientific research and planning work with a view to building and putting into operation new specializing plants for the manufacture of automatic lines and equipment for the lines.

To increase the production of lines, improve their operation, and decrease the cost of their production, machine-tool builders are working on the development of typical equipment for automatic lines and typical lines on which it will be possible to machine parts of similar shape which can be used for various purposes. For example, in almost every machine there are shafts, bushings, flanges and gears, the manufacture of which can be performed on typical equipment according to a typical process. Several hundred million gears alone are manufactured each year.

The first attempt to develop a typical line was made by ENIMS for machining stepped shafts for electric motors. A line which would require a minimum expenditure of time for resetting was needed to machine shafts of 12 types and sizes. At present, ENIMS is working on the development of other typical automatic lines.

It is urgently required that the proportion of operations performed on metal-cutting machine tools be reduced by sharply increasing the accuracy of casting, forging, and die forging processes, so that in the next few years parts and surfaces will have tolerances of tenths of a millimeter and will require no machining.

Besides introducing automatic lines and shops made up of new equipment, it is necessary for machine-building plants to concentrate on the development of automatic lines made up of their existing equipment. The experience in developing these lines at the KhTZ (Khar'kov Tractor Plant) as suggested by Inochkin, at the GPZ-1 (Moscow First State Bearing Plant imeni Kaganovich), according to Morozov's and Knyaz'kov's systems, and at the Moscow and Gor'kiy motor vehicle plants, as well as at other enterprises, proves the highly economic effectiveness of this practice.

Work on the development of automatic-transfer machine lines on the basis of utilizing available equipment is being done only from time to time. The development of these automatic lines is not being planned for the national economy as a whole. The experience of individual plants is not sufficiently publicized.

There are more than 100,000 automatic and semiautomatic machine tools in operation in machine building, primarily in mass production. A considerable portion of them are suitable for incorporation in automatic lines. If at least 10 percent of the available automatics and semiautomatics were used in lines, it would be possible to put at least 2,000 additional automatic and semiautomatic lines into operation in the next few years. This, in turn, would free at least 30,000 workers and improve labor conditions substantially.

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